

File - Test Section, Infantry Board

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REPORT

of

The Infantry Board

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No. 1584

FUZE, T-2, HAND GRENADE

FORT BENNING, GEORGIA

28 March 1944

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471.8 (C) (9 Apr 1944)
GNRQT-11/78584

9 Apr 1944

SUBJECT: Test of Fuze, T-2, Hand Grenade.

TO: Commanding General, Army Service Forces, Attention
Director, Requirements Division, Development Branch.

1. Herewith Infantry Board Report No. 1584 covering test of Hand Grenade Fuzes T-2.

2. The recommendations of the Infantry Board are approved and it is further recommended that all types of grenades employing the time delay fuze be equipped with the T-2 Fuze or one possessing the same characteristics.

For the COMMANDING GENERAL:

GEORGE SELENO

Major, A.G.D.,

Asst. Ground Adj. Gen.

1 Incl. (in dup)
IB Rpt #1584,
dtd 28 Mar 44.

FOR RECORD ONLY:

The T-2 Fuze is the result of efforts to develop a non-sparking and non-smoking fuze for use in the Mark II Hand Fragmentation Grenade.

This Copy For: Infantry Board

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IB-471.6

28 MAR 1944

SUBJECT: Fuse, T-2, Hand Grenade.

TO: Chief of Ground Requirements Section, Army Ground Forces,
Army War College, Washington, D. C.

1. Authority. The test of Hand Grenade Fuse, T-2, which is covered in detail in the attached Report of Test, was conducted under authority contained in 2nd Indorsement, Ground Requirements Section, Headquarters, Army Ground Forces, 3 March 1944, file 471.8 (C) (17 Feb 44) GNRQT-11/73656.

2. Factual Background.

a. Reports from combat theaters have indicated a general dissatisfaction with the Mark II, Fragmentation, Hand Grenade and particularly to the fact that the fuse emits a train of sparks visible at night which tends to disclose the position of the grenadier and to warn enemy personnel to take evasive and counter measures.

b. Infantry Board Report No. 1531.

Recommendations:

* * * *

"c. That prompt and intensive efforts be made to modify the present standard grenade, hand, fragmentation, Mark II, by providing it with ~~***~~ and a non-sparking fuse."

c. Infantry Board Report No. 1547.

Recommendations:

* * * *

"a. That all Grenades, Fragmentation, Hand, Mark II, now in the hands of troops be modified without delay by substitution of the T-1 Fuse assembly for the present fuses."

* * * *

"e. That the M10A1, M10A2 and M10A3 fuses for the Mark II fragmentation hand grenade be declared non-standard and their production, issue and use discontinued other than for training."

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3. Description of Material.

a. The T-2 Fuse is a detonating type fuse suitable for use with high explosive filled grenades and is similar in appearance to the T-1 and M10A3 fuzes. The safety lever is provided with a fork that engages under a T-lug on the fuse head. The fuse is equipped with a noiseless primer, a smokeless and sparkless fuse and an aluminum detonator cup containing 13-1/2 grains of PEEN (Pentaerthrite Tetranitrate). (Figures 1 and 2, Report of Test).

b. Two types of grenades were furnished for test as follows:

(1) Mark II, Fragmentation Hand Grenade, with T-2 Fuse, loaded with approximately 2 ounces of flake TNT.

(2) Mark II Fragmentation Hand Grenade with T-2 Fuse loaded with approximately 2 ounces of inert material.

c. The Mark II Fragmentation Hand Grenade with both the M10A3 and T-1 Fuzes were included for control and comparison. (Figure 3, Report of Test.)

4. Summary of Results of Tests.

a. The physical characteristics of the T-2 Fuse, as compared with Fuzes, M10A3 and T-1, are adequate and satisfactory. (Test No. 1.)

b. (1) The T-2 Fuzes are reliable in functioning. (Test No. 2.)

(2) The T-2 Fuse produces no noise when actuated other than a slight metallic sound caused by the safety lever being thrown free.

(3) The T-1 and M10A3 Fuzes produce a distinct explosive report when actuated.

(4) The burning time of the T-2 Fuse is 4.4 seconds with an average variation of .3 seconds. The lower time limit is 4.0 seconds, and the upper limit is 5.0 seconds.

(5) Neither the primer nor the time fuse of the T-2 Fuse assembly emits visible smoke.

(6) The T-1 and M10A3 Fuzes emit a distinct cloud of smoke.

(7) The T-2 Fuse functions without any visible flash or sparking.

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(8) The T-1 and M10A3 Fuzes produce a clearly visible flash at the instant when the striker actuates the fuse primer, but do not emit visible sparks during the burning of the time-train. (Test No. 2.)

c. The maximum range for effective bursts with hand grenades fitted with the M2 fuze, when projected from the M-1 Rifle with Grenade Launcher M-7 is 153 yards with the M3 Cartridge alone and 214 yards with the M3 Cartridge and M7 (Auxiliary) Cartridge. (Elevation 27 degrees and 18 degrees, respectively.) (Test No. 3.)

d. The maximum range for effective bursts of the hand grenade fitted with the M2 fuze when projected from the Carbine, M1, with Grenade Launcher, M-8, is 98 yards with the M6 Cartridge alone, and 211 yards with the M6 Cartridge and M7 (Auxiliary) Cartridge. (Elevations: 57 degrees and 27 degrees, respectively.) (Test No. 4.)

5. Conclusions. The Infantry Board concludes:

a. That the subject T-2 Fuze is satisfactory with respect to:

(1) Functioning, to include sound produced when the striker is actuated.

(2) Burning time of the fuze.

(3) Does not produce sparks or smoke.

(4) Maximum range, within the burning time of the fuze, when projected from the rifle and carbine.

b. That the subject T-2 Fuze is superior to M10A3 and T-1 Fuzes in that it does not produce a flash or report when actuated.

6. Recommendations. The Infantry Board recommends:

a. That the subject T-2 Fuze be adopted as standard for all Grenades, Fragmentation, Hand of future production.

b. That the subject T-2 Fuze be substituted for the present fuze on all Grenades, Fragmentation, Hand, now in the hands of troops, and all now in storage to which the change can be applied.

For the President:

INGOMAR M. OSETH,
Colonel, Infantry,
Director.

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M.D. 735022
Approved By AW NAKA Date 9 Dec 22

TEST SECTION
THE INFANTRY BOARD
FORT BENNING, GEORGIA

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23 MARCH 1944

SUBJECT: REPORT OF TEST OF FUZE, T2 HAND GRENADE

TO: THE PRESIDENT, THE INFANTRY BOARD, FORT BENNING, GEORGIA

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1. Authority and References.

a. Authority:

(1) Memorandum, The Infantry Board (IB-471.6) 7 March 1944.
(See Appendix "A")

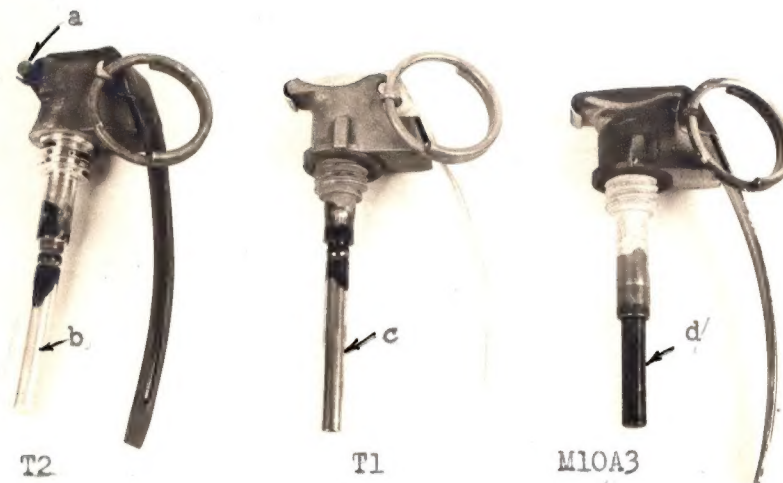
(2) Letter, Office of the Chief of Ordnance (O.O. 471.82/2249(c)), 17 February 1944 with two indorsements, Headquarters Army Service Forces (74318) 22 February 1944, and Ground Requirements Section, Hq., Army Ground Forces (GNGRT-11/73656) 3 March 1944. (See Appendix "B")

2. Introductory Information.

a. The subject fuze T2 is the result of recommendation initiated by Army Ground Forces that a better fuze than the M10A3 Hand Grenade fuze be produced to eliminate all sparking and to reduce smoke and noise to a minimum.

b. The T2 fuze is a detonating type fuze suitable for use with TNT filled grenades. The outward appearance of the fuze T2 is similar to that of the fuzes T1 and M10A3. (See Figure 1) The modifications visible on the T2 fuze are the Safety lever that incorporates a fork that hooks under a T-lug on the fuze head, (See Item a, Figure 1) and the detonating cup made of aluminum (See Item b, Figure 1). Internally, the T2 fuze is equipped with a noiseless primer, smokeless fuze and a detonator cup filled with 13-1/2 grains of PETN (Pentaerthrite Tetranitrate) (See Figure 2) Markings are in black on the safety lever and the end of the safety lever is black.

c. The Grenades incorporating the T2 fuze are of two types. The HE grenades are filled with 2 oz. of flaked TNT. It is easily recognized by the two yellow bands around the olive drab body. The practice grenade is assembled with the T2 fuze and filled with 2 oz. inert material. It is marked by a yellow band around the blue body.



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MK II GRENADE FUZES

- a. Forked Safety Lever and T-Lug
- b. Aluminum Detonator Cup
- c. Copper Detonating Cup (Standard No. 8 Cap)
- d. Black Powder Igniter

Figure 1

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MK II GRENADES

- a. HE with T-2 Fuze
- b. HE with M10A3 Fuze
- c. Practice (Dangerous) with T-2 Fuze

Figure 3

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3. Purpose of Test.

a. To compare the fuse T2 with the fuses M20A3 and T1 in regard to the following characteristics:

- (1) Functioning.
- (2) Sound produced when fuse is actuated.
- (3) Burning time of fuse.
- (4) Sparks and smoke produced by the fuse.
- (5) Maximum range, within burning time of the fuse that the grenade can be projected from the rifle.
- (6) Other pertinent data.

b. Note: Only 5 grenades fused with the T1 fuse were available for this test.

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4. Details of Tests and Results are as follows:

Test No. 1.

a. Purpose:

- (1) To compare the physical characteristics of the T2 fuse with those of the fuses T1 and M10A3.
- (2) To compare the physical characteristics of the grenades equipped with the T2, T1 and M10A3 fuses.

b. Method: By inspection, photography, and weighing.

c. Results:

- (1) Comparative physical characteristics of the T2, T1 and M10A3 fuses:

Fuze	T2	T1	M10A3
Type	Detonating	Detonating	Igniting
Booster Compound	PETN	Merc. Fulminate	Black Powder
Markings	Black letters and black tip on safety lever	Green letter on safety lever	Black letters and black tip on safety lever

- (2) Comparative physical characteristics of the MKII grenades with T2, T1 and M10A3 fuses.

Grenade	MK II (HE)	MK II (Prac)	MK II (HE)	MK II (HE)
Fuze	T2	T2	T1	M10A3
Filler	TNT	Inert	TNT	EC
Weight of Filler	2 oz.	2 oz.	2 oz.	3/4 oz.
Weight of Grenade	1.31#	1.31#	1.32#	1.26#
Color	Olive drab with 2 yellow bands	Blue with one yellow band	Olive Drab	Olive Drab

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Test No. 2.

a. Purpose: To compare the T2, T1 and M10A3 fuses in regard to the following characteristics:

- (1) Functioning.
- (2) Sound when striker is actuated.
- (3) Burning time of fuse.
- (4) Sparks and smoke produced by the fuse.

b. Method:

(1) By study of the MK II Grenades assembled with T2, T1 and M10A3 fuses, while in operation and recording of observations.

(2) Observations of the fuses were made both during daylight and darkness under the following conditions:

- (a) When thrown by hand.
- (b) When projected from a rifle.
- (c) When allowed to arm itself in the thrower's hand and burn for 1 second before throwing.
- (d) Night observations were made from the side as well as from the rear of the point of projecting and throwing the grenades.

c. Results:

(1) Functioning: Observations of functioning of fuses T2, T1 and M10A3 during all tests are tabulated below:

Type of fuse	T2	T1	M10A3
No. of Grenades fired	115	3	25
No. of Grenades functioning	114	3	25

Note: The T2 fuse that did not function was actuated in the hand of the thrower. The safety lever was released slowly, preventing the striker from making a full arc and striking the primer a hard blow. A similar case was experienced later when examining a T2 fuse. This fuse operated when the striker was allowed to make its full arc before striking the primer.

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(2) Sound when striker actuated.

(a) Careful observation of the functioning of the T2 fuse failed to disclose any trace of noise when the striker was actuated.

(b) In some instances a soft metallic sound was caused by the safety lever leaving the grenade.

(c) The T1 and M10A3 fuses are identical in operation. These fuses make a distinct explosive report when the striker actuates the primer of the fuse.

(3) Burning Time of Fuses.

(a) Careful timing of the fuses when thrown or projected gave the following tabulated results:

Type of Fuse	T2	T1	M10A3
No. of Fuses Tested	15	3	15
Average burning time	4.4 sec.	4.4 sec.	5.0 sec.
Variation of time of burning $\pm$ average	.3 sec.	.2 sec.	.2 sec.

(b) The time of the subject fuse T2 did not drop below 4.0 seconds nor did it go above 5.0 seconds.

(c) Although the variation of time of the T2 fuse is .1 seconds, more than the variation of either the T1 or the M10A3, the error is negligible.

(4) Smoke produced by burning fuse.

(a) Careful observation of the actuation and burning of the T2 fuse failed to reveal any trace of smoke due to the fuse primer or the fuse.

(b) The fuses T1 and M10A3 emit a puff of smoke when the fuse is actuated. A revealing cloud of smoke is generated by the actuated grenade fuse that can be seen for several hundred yards in daylight.

(5) Sparking produced by burning fuses.

(a) Careful observation of the actuation and burning of the T2 fuse at night failed to reveal any trace of flash from the primer or sparks from the fuse, while the grenade is moving through the air.

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By NARA Date 9 Dec 22

(b) The T1 and M10A3 fuzes make a clearly visible flash at night when the striker actuates the fuze primer, however they do not sparkle or leave a trail of light when projected or thrown.

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Test No. 3.

Weapon: M1 Rifle, M7 Launcher, M1 Projection Adapter - Rifle Rest.
Ammunition: M3 Cartridge, Auxiliary Cartridge M7.

a. Purpose: To compare the maximum range, with burning time of the fuze, that the grenades with T2 and M10A3 fuzes can be projected from the rifle and produce effective bursts.

b. Method:

(1) Mk II Hand grenades were launched from an M1 Rifle placed in a rifle rest. The angle of elevation was varied until approximately 50% of the grenades were bursting in the air and the other 50% on the ground.

(2) 15 grenades were fired at this elevation and the average range calculated from the ranges of the ground bursts.

(3) The same procedure was followed using the M3 Cartridge and Auxiliary Cartridge M7 as propellant.

c. Results: Tabulated below are the results of the range firing of the grenades:

Grenade	Propellant	Angle of Elevation	Maximum Range Obtained
MK II with T2 Fuze	M3 Cartridge	27°	153 yards
MK II with M10A3 Fuze	" "	27°	153 yards
MK II with T2 Fuze	M3 and M7 Cartridges	18°	214 yards
MK II with M10A3 Fuze	M3 and M7 Cartridges	18°	214 yards

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Test No. 4.

Conditions - Rain.

Temperature - 70° F.

Weapon - Carbine M1, M8 Launcher, M1 projection adapter and rifle rest.

Ammunition: M6 cartridge, auxiliary cartridge M7.

a. Purpose: To compare the maximum range, with burning time of the fuze, that the grenades with T2 and M10A3 fuzes can be projected from the carbine and produce effective bursts.

b. Method:

(1) Mk II hand grenades were launched from an M1 carbine placed in a rifle rest. The angle of elevation was varied until approximately 50% of the grenades were bursting in the air and the other 50% on the ground.

(2) 10 grenades were fired at this elevation and the average range calculated from the ranges of the ground bursts.

(3) The same procedure was followed using the M6 cartridge and the Auxiliary cartridge M7 as propellant.

c. Results: (1) Tabulated below are the results of the range firing of the grenades:

<u>Grenade</u>	<u>Propellant</u>	<u>Angle of elevation</u>	<u>Max. range obtained</u>
Mk II with T2 fuze	M6 Cartridge	57°	98 yards
Mk II with M10A3 fuze	M6 Cartridge	57°	98 yards
Mk II with T2 fuze	M6 and M7 Cartridges	27°	211 yards
Mk II with M10A3 fuze	M6 and M7 Cartridges	27°	211 yards

(2) Utilizing the M6 Cartridge together with the M7 Auxiliary Cartridge extended the range of the grenade 113 yards or an increase of approximately 105 per cent. It is believed that this increased range is due to the fact that the auxiliary cartridge M7 contains approximately the same amount of powder as the cartridge M6.

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5. Summary of Facts Determined by Tests.

The foregoing tests have disclosed the following facts.

- a. One hundred and fourteen of the 115 T2 fuzes tested functioned, 25 of the 25 M10A3 fuzes tested functioned and 3 of the 3 T1 fuzes tested functioned. (Test No. 2)
- b. The T2 fuze makes no noise when actuated other than the metallic sound of the safety lever being thrown free. The T1 and M10A3 fuzes make a distinct explosive report when actuated. (Test No. 2)
- c. The T2 and M10A3 fuzes have an average burning time of 4.4 seconds. The T1 fuze has an average burning time of 5.0 seconds (Test No. 2)
- d. The T2 fuze does not emit smoke. The T1 and M10A3 fuzes both smoke visibly and leave a trail of smoke when thrown by hand or projected from a rifle. (Test No. 2)
- e. The T2, T1 and M10A3 fuzes do not sparkle. The T1 and M10A3 fuzes make a visible flash when the fuze primer is actuated. The primer of the T2 fuze does not flash when actuated. (Test No. 2)
- f. The maximum range of Mk II Grenades fuzed with the T2 and M10A3 fuzes are the same when projected from a rifle with the M1 projection adapter, utilizing the M3 cartridge. The maximum range obtained was the same for both grenades when using the M3 cartridge and M7 Auxiliary cartridge. The maximum range obtained with the M3 Cartridge is 153 yards and with the M3 and M7 Auxiliary Cartridge 214 yards. (Test No. 3)
- g. The maximum range of the Mk II Grenades fuzed with the T2 and M10A3 fuzes are the same when projected from the carbine M1 with the M1 projection adapter, utilizing the M6 cartridges. The maximum range obtained was the same for both grenades when using the M6 cartridge and the M7 Auxiliary cartridge as propellants. The maximum range obtained with the M6 cartridge is 98 yards and with the M6 cartridge and the M7 Auxiliary cartridge 211 yards. (Test No. 4)

WILLIAM S. SINCLAIR, JR.,
Captain, Infantry,
Test Officer.

I concur in the above report:

WILLIAM C. RUTHERFORD,
Lt. Colonel, Infantry,
Chief of Test Section.

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